



Original Contribution

**CONTRIBUTION TO THE KNOWLEDGE OF NYMPHALIDAE FAUNA
(LEPIDOPTERA: RHOPALOCERA) IN KOSOVO**

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ABSTRACT

Insects of the order Lepidoptera are among the most explored in Europe. This order is presented with a rich variety, especially in the Balkan Peninsula, which includes also the state of Kosovo. In this paper the results of the research of Nymphalidae family in the region of Llapusha in Kosovo, specifically in the southern part of the mountain ranges of Shkoza, for the period April to July 2016 are presented. As a result of this research 35 species of Nymphalidae butterflies have been recorded, among them *Melanargia russiae* (Esper 1783) as a new species for Kosovo. This research is conducted five years after a first study of butterflies in this region took place and four years after the wildfire occurred in the area, which destroyed a large part of the vegetation. After this period, as a result of secondary succession, there is a renewal of vegetation, and a significant number of Nymphalidae butterflies.

Key words: Butterflies, mountain range Shkoza, biodiversity, fire

INTRODUCTION

The existing data on the Lepidoptera fauna in Kosovo include mainly those from Rebel and Zerny (1, 2) and Jakšić (3-5) that were conducted in national parks Sharri and Bjeshkët e Nemuna (Accursed Mountain) and the mountain of Pashtriku. The mountain range of Shkoza is located in the central part of Kosovo and they divide the region of Llapusha from the Anadrini region. Its terrain configuration is hilly mountainous with an altitude of 640m up to 893m. The initial part of the mountain range is characterized by low mountains in the North and North West, while in the Northeastern part begins a narrow valley. The climate of this region is continental, with some different elements of Mediterranean climate, which is characterized by cold winters and long, hot and dry summers. Because of the limestone composition of rocks, the soil composition is "terra rossa" (red soil). The geologic structure, altitude and weather conditions have contributed that this area has a pretty rich diversity of flora and fauna.

The massif area of Shkoza is very rich in plant species starting from those low up to vascular one. In this region appears the plant association *Quercetum pubescentis-cerris* (6). Due to the large presence of wood hornbeam – *Carpinus betulus* (White hornbeam) and *Carpinus orinetalis* (black hornbeam), these ridges were named Shkoza - Hornbeam. Characteristic of this region is the drought during the summer due to the insufficiency of water resources.

MATERIAL AND METHOD

The research was conducted during the months April to July 2016 in 11 localities in the massif of Shkoza (**Figure 1**). The butterflies were collected by entomological net; they were observed, photographed and identified in the field, only a number of samples were preserved for further studies. The determination is performed in Zoology lab at the Department of Biology of the University of Prishtina "Hasan Prishtina". Identification is based according to Tolman and Lewington (7) and Misja (8). In addition to these sources, the website www.lepiforum.de (11) was consulted.

Data calculation

Species richness, number of specimens-abundance, Shannon-Wiener diversity index H' (diversity of species in a sample), Evenness index E (quantitative representation of specimens among species in a sample) and

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Sørensen's similarity index-So, were calculated using ComEcoPaC – Community Ecology

Parameter Calculator. Version 1. (12)

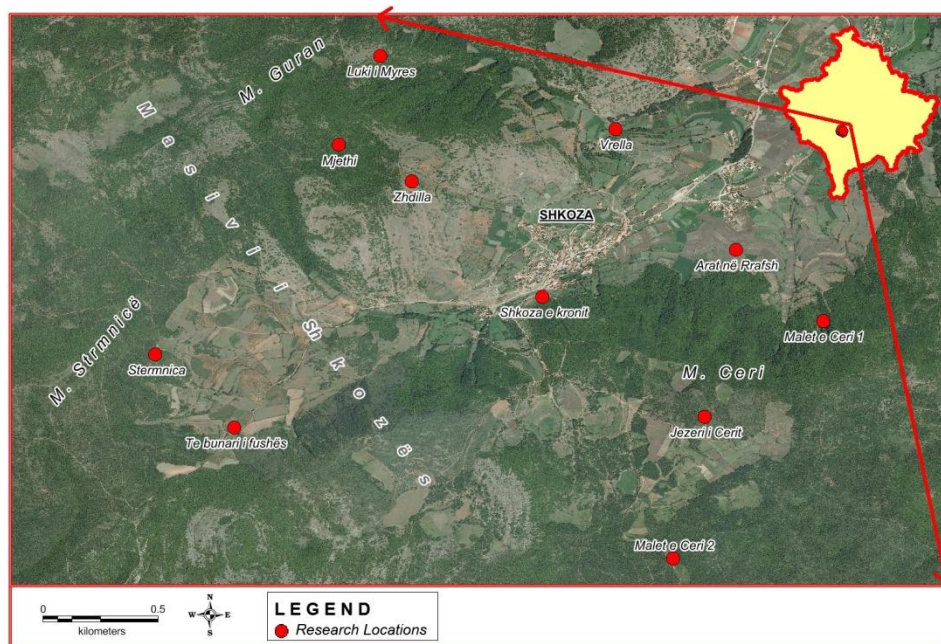


Figure 1. Map with surveyed localities

Table 1. Surveyed localities with habitat types, coordinates and altitude

	Localities	N	E	Altitude
1.	Mjethi (Dry meadows with pastures)	42° 25'00. 40"	20° 42' 06.19"	712m
2.	Te bunari i fushës (Agro ecosystems with water springs in the vicinity and animal stables)	42 °24'45. 57"	20 ° 41' 46.10"	706m
3.	Stermnica (Woodland combined with grasslands with many pioneer species occurred after the fire in 2012)	42 °25'00. 20"	20 ° 41' 30. 95"	765m
4.	Zhdilla(Dry meadows with mixed woodland)	42 °25'32. 44"	20 ° 42' 19.54"	753m
5.	Arat në Rrafsh (Agroecosystems)	42 °25'19. 72"	20 ° 43' 21.71"	576m
6.	Vrella (Agroecosystems with water springs in the vicinity)	42 °25'42. 87"	20 ° 42' 58.49"	574m
7.	Malet e Cerit 1 (Woodland and woodland margins)	42 ° 43'39. 56"	20 ° 43' 39.56"	683m
8.	Malet e Cerit 2 (Woodland with alpine meadows)	42 ° 24'20. 96"	20 ° 43' 10.22"	756m
9.	Shkoza e kronit (Inside the settlements, near the area with wastes)	42 ° 25'10. 51"	20 ° 42' 45.32"	623m
10.	Jezeri i Cerit(Woodland with dry rocky meadows)	42 ° 24'48. 37"	20 ° 43'15. 72"	751m
11.	Luki i Myres (Woodland combined with mixed rocky meadows)	42 °25'56. 79"	20 ° 42'13. 56"	745m

RESULTS

Table 2. List of the butterfly species of the family Nymphalidae recorded in the studied area, the localities of the record (according to the numbers in the Map of localities) and their IUCN status

Class: Insecta Order: Lepidoptera Family: Nymphalidae	Locality where the species is recorded	Threatened status according to IUCN
<i>Arethusana arethusa</i> (Denis&Schifferrmüller, 1775)	3,10	LC
<i>Issoria lathonia</i> (Linnaeus,1758)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Boloria dia</i> (Linnaeus,1767)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Brenthis hecate</i> (Denis & Schifferrmüller,1775)	1,2,4,5,6,9,10	LC
<i>Brenthis daphne</i> (Denis & Schifferrmüller,1775)	1,2,3,10	LC
<i>Agalis urticae</i> (Linnaeus,1758)	1,6	LC
<i>Argynis niobe</i> (Linnaeus,1758)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Aglais io</i> (Linnaeus,1758)	1,2,4	LC
<i>Argynnis pahia</i> (Linnaeus,1758)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Argynnis aglaja</i> (Linnaeus,1758)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Coenonympha pamphilus</i> (Linnaeus,1758)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Vanessa atalanta</i> (Linnaeus,1758)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Vanessa cardui</i> (Linnaeus,1758)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Polygonia c- album</i> (Linnaeus,1758)	1,2	LC
<i>Chazara briseis</i> (Linnaeus, 1764)	4	NT
<i>Melitaea triva</i> (Denis & Schifferrmüller,1775)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Melitaea cinixia</i> (Linnaeus,1758)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Melitaea didyma</i> (Esper, 1778)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Melitaea athalia</i> (Rottemburg, 1775)	3,7,8,10	LC
<i>Melitaea phoebe</i> (Denis & Schifferrmüller,1775)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Melanargia galathea</i> (Linnaeus,1758)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Melanargia larissa</i> (Geyer,1828)	1,2,4,5,	LC
<i>Melanargia russiae</i> (Esper,1783)	2,4	LC
<i>Ceonomypha arcania</i> (Linnaeus,1761)	3	LC
<i>Boloria euphrosyne</i> (Linnaeus,1758)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Maniola jurtina</i> (Linnaeus,1758)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Hipparchia fagi</i> (Scopoli,1763)	7,8,10,11	NT
<i>Hipparchia volgensis</i> (Mazochin - Porshnjakov, 1952)	1,2,7,10,11	LC
<i>Hipparchia fatua</i> (Freyer, 1844)	8,10	LC
<i>Hipparchia syriaca</i> (Staudinger, 1871)	2,3,4,7,8,9,10,11	LC
<i>Hipparchia statilinus</i> (Hufnagel, 1766)	8,10	NT
<i>Hyponephele lupines</i> (Costa,1776)	1,2,3,4, 6,7,8,9,10,11	LC
<i>Kirinia roxelana</i> (Cramer, 1777)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Limenitis reducta</i> (Staudinger, 1901)	1,2,3,4,5,6,7,8,9,10,11	LC
<i>Lasiommata megera</i> (Linnaeus,1767)	1,2,3,4,5,6,7,8,9,10,11	LC

Table 3. Species richness (S), number of specimens–abundance (N),Shannon-Wiener diversity index (H') and Evenness–E, for each sampling locality

Indices	Surveyed localities										
	1	2	3	4	5	6	7	8	9	10	11
Species richness-S	26	27	24	25	20	19	23	24	22	27	22
Abundance -N	160	125	124	110	107	94	98	141	126	137	113
Shannon Wiener diversity index- H'	4.46	4.56	4.42	4.41	4.06	4.05	4.25	4.39	4.34	4.58	4.30
Evenness - E	0.950	0.966	0.966	0.965	0.967	0.966	0.963	0.964	0.964	0.966	0.966

Table 4. Sørensen's similarity index-So

So	Sam.2	Sam.3	Sam.4	Sam.5	Sam.6	Sam.7	Sam.8	Sam.9	Sam.10	Sam.11
Sam.1	94%	80%	86%	87%	84%	82%	76%	83%	83%	83%
Sam.2		82%	92%	85%	78%	84%	78%	86%	85%	86%
Sam.3			82%	82%	84%	89%	88%	91%	86%	87%
Sam.4				89%	82%	83%	82%	89%	81%	85%
Sam.5					87%	84%	82%	90%	81%	86%
Sam.6						86%	84%	88%	78%	88%
Sam.7							94%	93%	88%	98%
Sam.8								91%	90%	91%
Sam.9									86%	91%
Sam.10										90%

Table 5. Number of Nymphalidae species recorded in some of the mountain areas in Republic of Kosovo

Family Nymphalidae	Massif of Shkoza	National Park Sharri	National Park Bjeshket e Nemuna	Pashtrik Mountain
Number of recorded species	35	65	68	38

DISCUSSION

As shown in **Table 2** in the researched area 35 species of the Nymphalidae butterflies have been recorded, which represents a fairly prosperous diversity for this region. 19 species were present in all localities of the research, whereas 2 species were recorded only in one of the localities. In this research the species *Melanargia russiae* (ESPER, 1783) was recorded for the first time in Kosovo. *Melanargia russiae* is recorded in June and July in several habitats throughout the village where its caterpillar live on various gramineae plants of the family Poaceae. This species is also reported in the neighboring countries of Kosovo. According to the earlier records (8), in Albania *Melanargia russiae* was found only in the Tomorri Mountain, but the most recent data on the butterflies of Albania (9) have shown that *Melanargia russiae* is fairly widespread and recorded in eight (8) observation locations on the territory of Albania.

It is worth noting the large presence of *Hipparchia volgensis* (Mazochin - Porshnjakov, 1952), an European endemic species, during the month of June in the territory of Shkoza in dry and hot areas, habitats of deciduous forests, in arid hills areas and different rock slopes and in the compound silicate soils in some of the surveyed localities. (**Table 2**) This species is presented with a large number of specimens, thus in a numerically large population. According the data from the IUCN Red List of Threatened Species (2016) this species is native in Bulgaria, Greece, FYR

Macedonia, Romania, Serbia, the Russian Federation and Turkey. Its appearance varies at different altitudes from 600 to 1.500 m, sometimes 2.500 m. According to the literature (7) this species has spread in Albania too. In Kosovo this species was earlier reported in the Pashtrik Mountain (5) as *Hipparchia delattini* (Kudrna, 1975).

Regarding the species richness, all the surveyed localities hosted more than 50% of species. However the richest were localities 2 and 10 with 27 species out of recorded 35. These two localities have also the highest value of Shannon –Wiener diversity index, $H' = 4.56$, respectively 4.58, indicating the high species diversity in a sample. The quantitative (numerically) distribution of individuals among species, evenness E index has a high value ranging from 0.93 to 0.97 in all surveyed localities, indicating that relatively equal numbers of individuals belong to each species. In respect to abundance N, the highest number of specimens, total 160, is recorded in the locality 1, whereas the poorest was in locality 6 with only 94. (**Table 3**)

Based on the values of Sørensen's similarity index-So (**Table 4**) it can be seen that all the localities in our survey share almost 80 % of species. The highest similarity in species composition was registered between the localities 1 and 2, $So = 94\%$, with 25 shared species. The lowest similarity, 76% was between localities 1 and 8 with 17 shared species. The difference in species composition between these two localities can be justified

as the result of different habitat types in these two localities. (**Table 1**)

Based on the European Red List of Butterflies (10) from 35 species recorded in our research, 29 species belong to the category LC (Least Concern), three other species: *Hipparchia fagi*, *Hipparchia statilinus* and *Chazara briseis* belonging to the category NT (Near threatened). In a research conducted in 2011 in the same area total of 44 butterflies species were recorded, 22 of them from the family Nymphalidae. It is worth mentioning that during that time the field visits have not been on regular basis, which can justify the small number of species encountered in comparison with this research. A year later a big part of this massif was burned, and then, four years later, the secondary succession took place, where a number of pioneer species appeared. It remains to be discussed the question of whether the largest number of butterflies species in this research is the result of more frequent field visits or is it because of the change of the vegetation as a result of secondary succession, four years after the wildfire in this part of the mountain. However, given the fact that the family Nymphalidae is the most widespread family of butterflies in Europe, (10) it turns out that this family is also pretty widespread in our country. Comparing the number of 35 Nymphalidae species recorded in our research with the number of species from previous research in territory of the Republic of Kosovo (**Table 2**), it is very close with Pashtrik Mountain (5) where 38 species were found. This is expected due to very similar geologic structure and climate conditions of these two mountains. The richest butterfly fauna of Nymphalidae family, composed from 69 species was recorded from National Park "Bjeshket e Nemuna"(4) located in the western part of Kosovo. A pretty high number of Nymphalidae species-65, was also registered in both sides of National Park Sharri that lies on the border between Kosovo and Macedonia (3).

CONCLUSION

As a result of this research, we came to the conclusion that thanks to bio-geological, geographic and climatic characteristics of the researched area, Shkoza massif presents a rich diversity of the fauna of butterflies. The recorded Nymphalidae species in this area constitutes approximately 14% of the number of European Nymphalidae species and more than 50% of species recorded in our country. However, to know fully the butterfly diversity in this mountain massif, the research should be expanded throughout its length, with

more attention to be given to dry, open rocky habitats where the presence of some other species may be expected.

Furthermore, research should be repeated in areas previously surveyed in order to follow the changes in the diversity of butterfly fauna, considering the long time that has elapsed and the changes that have swept the country over the past two decades.

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